

# National Advisory Committee for Aeronautics

## Research Abstracts

NO.43

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### CURRENT NACA REPORTS

NACA Rept. 1075

HYDRODYNAMIC IMPACT OF A SYSTEM WITH A SINGLE ELASTIC MODE. II-COMPARISON OF EXPERIMENTAL FORCE AND RESPONSE WITH THEORY. Robert W. Miller and Kenneth F. Merten. 1952. ii, 7p. diagrs., photos., tab. (NACA Rept. 1075. Formerly TN 2343)

Hydrodynamic impact tests were made on an elastic model approximating a two-mass-spring system which had a ratio of sprung mass to hull mass of 0.6 and a natural frequency of 3.0 cycles per second. Tests were made at two combinations of trim and flight-path angles and for a range of flight-path velocity. Comparison of the experimental results with results obtained from the theory of NACA TN 1398 showed good agreement.

NACA Rept. 1078

EFFECTS OF COMPRESSIBILITY ON THE PERFORMANCE OF TWO FULL-SCALE HELICOPTER ROTORS. Paul J. Carpenter. 1952. ii, 8p. diagrs., photo. (NACA Rept. 1078. Formerly TN 2277)

An investigation has been conducted on the Langley helicopter test tower to determine experimentally the effects of compressibility on the performance and blade pitching moments of two full-scale helicopter rotors with twisted and untwisted blades over a tip-speed range from 350 to 770 feet per second.

NACA Rept. 1081

A STUDY OF SECOND-ORDER SUPERSONIC FLOW THEORY. Milton D. Van Dyke. 1952. ii, 23p. diagrs. (NACA Rept. 1081. Formerly TN 2200)

Second-order solutions of supersonic-flow problems are sought by iteration, using the linearized solution as the first step. For plane and axially symmetric flows, particular solutions of the iteration equation are discovered which reduce the second-order problem to an equivalent linearized problem. Comparison of second-order solutions with exact and numerical results shows great improvement over linearized theory. For full three-dimensional flow, only a partial particular solution is found. The inclined cone is solved, and the possibility of treating more general problems is considered.

NACA Rept. 1089

SINGLE-DEGREE-OF-FREEDOM-FLUTTER CALCULATIONS FOR A WING IN SUBSONIC POTENTIAL FLOW AND COMPARISON WITH AN EXPERIMENT. Harry L. Runyan. 1952. ii, 8p. diagrs. (NACA Rept. 1089. Formerly TN 2396)

The effect of Mach number and structural damping on single-degree-of-freedom pitching of a wing is presented. Some experimental results are compared with theory and good agreement is found for certain ranges of an inertia parameter.

NACA TN 2926

STATIC FORCE-DEFLECTION CHARACTERISTICS OF SIX AIRCRAFT TIRES UNDER COMBINED LOADING. Walter B. Horne. May 1953. 92p. diagrs., photos., 2 tabs. (NACA TN 2926)

Static force-deflection tests were made on six aircraft tires. These tests included the vertical loading of the six tire specimens, combined vertical loading and side loading and combined vertical loading and torsional loading of five tire specimens, and combined vertical loading and fore-and-aft (longitudinal) loading of one tire specimen for different initial inflation pressures. Tire deflection, vertical-load center-of-pressure shifts, and tire pressure measurements are presented for the different load combinations. The lateral spring constants for all the tire specimens tested decreased with increasing vertical tire deflection; whereas, the torsional and fore-and-aft spring constants increased with increasing vertical tire deflection. The lateral and fore-and-aft shifts of the vertical-load center of pressure were found to average 75 percent and 25 percent, respectively, of the side and fore-and-aft tire deflections.

NACA TN 2927

DEFLECTION OF DELTA WINGS HAVING A CARRY-THROUGH-BAY CHORD SMALLER THAN THE WING ROOT CHORD. Roger W. Peters and Manuel Stein. May 1953. 25p. diagrs., photo., 2 tabs. (NACA TN 2927)

Experimentally determined influence coefficients are presented for the deflection of two solid delta wings - one wing of constant thickness and the other of constant thickness ratio - having a carry-through-bay chord smaller than the wing root chord. A theoretical method of analysis is demonstrated for the constant thickness wing under tip load, and the theoretical results are compared with the experimental results.

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## NACA TN 2928

AXIAL-LOAD FATIGUE PROPERTIES OF 24S-T AND 75S-T ALUMINUM ALLOY AS DETERMINED IN SEVERAL LABORATORIES. H. J. Grover and W. S. Hyler, Battelle Memorial Institute, Paul Kuhn and Charles B. Landers, Langley Aeronautical Laboratory and F. M. Howell, Aluminum Company of America. May 1953. 63p. photos., diagrs., 7 tabs. (NACA TN 2928)

In the initial phase of an NACA program on fatigue research, axial-load tests on 24S-T3 and 75S-T6 aluminum-alloy sheet have been made at the Battelle Memorial Institute and at the Langley Aeronautical Laboratory of the NACA. The test specimens were polished and unnotched. The manufacturer of the material, the Aluminum Company of America, has made axial-load tests on 24S-T4 and 75S-T6 rod material. The test techniques used at the three laboratories are described in detail; the test results are compared with each other and with results obtained on unpolished sheet by the National Bureau of Standards.

## NACA TN 2929

EXPERIMENTAL INVESTIGATION OF THE EFFECT OF REAR-FUSELAGE SHAPE ON DITCHING BEHAVIOR. Ellis E. McBride and Lloyd J. Fisher. April 1953. 35p. diagrs., photos., 3 tabs. (NACA TN 2929)

An experimental investigation was conducted to determine the effect of rear-fuselage shape on ditching behavior. The basic fuselages were streamline bodies of revolution of fineness ratios 6 and 9. Variations in longitudinal curvature were obtained by sweeping up or sweeping down the rear half of the center line. A change in the cross section was obtained by splitting the center line in the plan view. The models were landed in calm water at speeds of 30, 40, 50, and 60 feet per second. The effects on ditching behavior of changes in longitudinal curvature, cross section, fuselage fineness ratio, and landing speed are presented in terms of maximum height of the center of gravity, maximum attitude, length of run, and skipping tendency.

## NACA TN 2932

WATER-LANDING INVESTIGATION OF A FLAT-BOTTOM V-STEP MODEL AND COMPARISON WITH A THEORY INCORPORATING PLANING DATA. Robert W. Miller. May 1953. 23p. diagrs., photo., 2 tabs. (NACA TN 2932)

This paper presents the results of a fixed-trim smooth-water impacts of a flat-bottom V-step model having a high beam loading. Plots of nondimensional load, draft, vertical velocity, and time against flight-path angle at water contact show results similar to those exhibited by other models having transverse steps, high beam loadings, and different shapes. Time-history comparisons show good agreement between experimental results and results computed by the method of NACA TN 2814 for the V-step case.

## NACA TN 2934

RELATION BETWEEN ROUGHNESS OF INTERFACE AND ADHERENCE OF PORCELAIN ENAMEL TO STEEL. J. C. Richmond, D. G. Moore, H. B. Kirkpatrick and W. N. Harrison, National Bureau of Standards. April 1953. 29p. diagrs., photos., 7 tabs. (NACA TN 2934)

The relationship between adherence and roughness of interface between enamel and iron was studied. Porcelain-enamel ground coats were prepared and applied under conditions that gave various degrees of adherence. The variations were produced by (a) varying the amount of cobalt-oxide addition in the frit; (b) varying the type of metallic-oxide addition in the frit, keeping the amount constant at 0.8 weight percent; (c) varying the surface treatment of the metal before application of the enamel, by pickling, sandblasting, and polishing; and (d) varying the time of firing of the enamel containing 0.8 percent of cobalt oxide. A positive correlation was found between adherence and roughness of the interface.

## NACA TN 2936

COMBUSTION INSTABILITY IN AN ACID-HEPTANE ROCKET WITH A PRESSURIZED-GAS PROPELLANT PUMPING SYSTEM. Adelbert O. Tischler and Donald R. Bellman. May 1953. 50p. diagrs., photo. (NACA TN 2936. Formerly RM E51G11)

The low-frequency instability problem of a rocket using liquid propellants and a pressurized-gas propellant pumping system was experimentally investigated with a 300-pound thrust acid-heptane rocket. The results were compared to results predicted by an analysis based on the premise that the instability was due to an out-of-phase coupling between propellant flow and combustion-chamber pressure. The calculated instability frequency conformed with those observed experimentally and the analysis predicted many of the observed trends of varying rocket design or operating parameters.

## NACA TN 2937

METHOD FOR CALCULATING THE ROLLING AND YAWING MOMENTS DUE TO ROLLING FOR UNSWEPT WINGS WITH OR WITHOUT FLAPS OR AILERONS BY USE OF NONLINEAR SECTION LIFT DATA. Albert P. Martina. May 1953. 41p. diagrs., 11 tabs. (NACA TN 2937)

The methods of NACA Reports 865 and 1090 have been applied to the calculation of the rolling- and yawing-moment coefficients due to rolling for unswept wings with or without flaps or ailerons. The methods allow the use of nonlinear section lift data together with lifting-line theory. Two calculated examples are presented in simplified computing forms in order to illustrate the procedures involved.

NACA TN 2938

ANALYSIS OF HEAT ADDITION IN A CONVERGENT-DIVERGENT NOZZLE. Donald P. Hearth and Eugene Perchonok. April 1953. 18p. diags. (NACA TN 2938)

The effect of heat addition to a divergent stream with initially sonic flow is analyzed and the variation of exit Mach number, static pressure, and total pressure is presented. Application of these results to the diverging portion of a convergent-divergent nozzle indicated that nozzle heat addition delays nozzle overexpansion and affects the jet thrust appreciably. Moreover, misleading nozzle coefficients will be computed if heat addition in the nozzle is ignored.

NACA TN 2939

OPTIMUM CONTROLLERS FOR LINEAR CLOSED-LOOP SYSTEMS. Aaron S. Boksenbom, David Novik and Herbert Heppler. April 1953. 27p. diags. (NACA TN 2939)

An analysis is made for optimum controllers of general, linear, time-invariant multiloop systems based on minimizing the mean squares or integral squares of errors and constrained variables for either stationary statistical or transient inputs. A general method of using open-loop optimum filter theory is derived that assures structural stability of the closed-multiloop system during the optimization process. General solutions were obtained for certain special cases and applied to examples of turbojet engine control.

NACA TN 2940

EFFECT OF HIGH BULK TEMPERATURES ON BOUNDARY LUBRICATION OF STEEL SURFACES BY SYNTHETIC FLUIDS. S. F. Murray, Robert L. Johnson and Edmond E. Bisson. May 1953. 27p. diags., photos., 2 tabs. (NACA TN 2940)

An experimental study was made of the effect of high lubricant bulk temperatures on the boundary lubricating effectiveness with steel surfaces of various types of synthetic fluids considered as lubricants for turbine engines. Synthetic fluids were generally effective lubricants at higher temperatures than comparable petroleum. Lubrication with esters and possibly other fluids is believed to result from formation of a chemisorbed soap film by free acids (contaminants) in the fluid. Failure results from deterioration of metal soap and oxide films, which is influenced by temperature effects on the bulk fluid. Thermal stability can be associated with viscosity grade within a given class; however, no correlation could be made between lubrication failure temperature and the viscosity at failure temperatures for the various fluids. At temperatures up to its decomposition point, a silicate ester showed more promise than the other lubricants studied.

NACA TN 2944

THE ZERO-LIFT DRAG OF A SLENDER BODY OF REVOLUTION (NACA RM-10 RESEARCH MODEL) AS DETERMINED FROM TESTS IN SEVERAL WIND TUNNELS AND IN FLIGHT AT SUPERSONIC SPEEDS. Albert J. Evans. April 1953. 40p. diags., tab. (NACA TN 2944)

Presents zero-lift drag data of an NACA RM-10 slender body of revolution with and without stabilizing fins attached. The results from several wind tunnels and in flight are compared. The results cover a Reynolds number range from about  $1 \times 10^6$  to  $40 \times 10^6$  for the wind-tunnel models and  $12 \times 10^6$  to  $140 \times 10^6$  for the flight models. The Mach numbers covered include 1.5 to 2.4 in the wind tunnels and 0.85 to 2.5 in flight.

NACA TN 2948

INVESTIGATION OF LATERAL CONTROL NEAR THE STALL. FLIGHT INVESTIGATION WITH A LIGHT HIGH-WING MONOPLANE TESTED WITH VARIOUS AMOUNTS OF WASHOUT AND VARIOUS LENGTHS OF LEADING-EDGE SLOT. Fred E. Weick, Maurice S. Sevelson, James G. McClure and Marion D. Flanagan, Agricultural and Mechanical College of Texas. May 1953. 61p. diags., photos., 4 tabs. (NACA TN 2948)

Flight tests were made with a light high-wing monoplane to investigate possibilities for obtaining satisfactory lateral control at low flight speeds. The airplane was tested with a plain straight wing, with the wing twisted to various amounts of washout, and with leading-edge slots covering various portions of the span. With each wing configuration the tests were repeated with power on and off and for three center-of-gravity locations. The flow over the wing was observed by means of tufts attached to the upper surface. The results of the tests indicate that reliable control at angles of attack very near the stall can be achieved by the proper use of leading-edge slots and wing washout.

NACA TM 1347

REPORT ON THE SPECIAL FIELD "INTERFERENCE" TO THE WIND-TUNNEL COMMITTEE IN FEBRUARY 1945. (Bericht über das Fachgebiet Interferenz vor dem Windkanalausschuss im Februar 1945). H. Schlichting. Includes: Compilation of Interference Systematics at the Aerodynamic Institute of the Technical Academy Braunschweig. E. Moller. May 1953. 46p. diags. (NACA TM 1347. Trans. from Technische Hochschule Braunschweig. Aerodynamisches Institut. Bericht 45/4)

Contains an outline of investigations dealing with interference effects on the static stability of various airplane configurations that were conducted, were being conducted, and were started at the time of this present report. Results of several investigations are presented and discussed briefly. A supplement is attached showing the configurations tested and outlining the various test programs. Suggestions for future investigations are also included.

NACA TM 1353

SOME PROBLEMS OF THE THEORY OF CREEP. (Nekotorye Voprosy Teorii Polzuchesti). Y. N. Rabotnov. April 1953. 19p. diagrs. (NACA TM 1353. Trans. from Vestnik Moskovskovo Universiteta, no. 10, 1948, p.81-91).

A theory of creep is proposed which represents an extension of the theory of elastic heredity of Volterra to plastic deformation. The theory is applied to the problems of relaxation, reverse creep, creep-bending of bars, and creep of a pipe under internal pressure. A special class of three-dimensional problems, in which the relative magnitudes of the stresses at a point remain constant with time, and likewise the relative magnitudes of the strains, is also considered.

## BRITISH REPORTS

N-21249 \*

Forest Products Research Lab. (Gt. Brit.)  
MOISTURE RELATIONS OF COMPOSITE WOOD PRODUCTS. THE MOVEMENT OF PLYWOOD (Part IV). PROGRESS REPORT TWENTY-THREE. R. J. Newall and G. E. Soane. February 1953. 4p. (Forest Products Research Lab.)

This report gives data on the swelling of plywood of 30 species. Routine measurements have been made on the movement of samples of all species tested for plywood manufacture.

N-21447 \*

Department of Supply (Australia)  
TORSION AND BENDING OF SWEEP AND TAPERED WINGS WITH RIGID CHORDWISE RIBS. W. H. Wittrick. September 1950. 85p. diagrs., 24 tabs. (Department of Supply. ACA-51)

The problem considered is that of a swept wing, either conical or cylindrical, of arbitrary section, under any system of bending and torsion loads. The wing is assumed to consist of a nonbuckling outer skin, a series of booms and stringers located along generators of the tube, and a series of closely spaced ribs all parallel to the root section. The ribs are assumed to be completely rigid in their own planes but to offer no resistance to warping out of their own planes. For simplicity only single-cell tubes are considered.

N-21676 \*

Forest Products Research Lab. (Gt. Brit.)  
INVESTIGATIONS INTO GLUES AND GLUING. PROGRESS REPORT SEVENTY-ONE - SEPTEMBER 1952. BEHAVIOUR OF GLUED WOOD PRODUCTS IN LIGHT NAVAL CRAFT. THIRD YEAR'S ANALYSIS. R. J. Newall and L. S. Doman. 6p. (Forest Products Research Lab.)

This report presents a summary of results of periodic inspections made during the previous three years on glued wood products used in boats.

N-21803 \*

Aeronautical Research Council (Gt. Brit.)  
NO. 2, 11 $\frac{1}{2}$ -FT WIND-TUNNEL TESTS OF A SMALL SPAN, SMALL CHORD DOUBLE AILERON FOR USE AS A LATERAL CONTROL ON A HIGH-LIFT AIRCRAFT. A. D. Young and W. S. D. Marshall. 1952. 32p. diagrs., 5 tabs. (ARC R & M 2536; ARC 9565. Formerly RAE Aero 2111)

Tests were made on a 1/2. 25-scale model of a half wing of the Master. The span of the aileron was 0.22s and the chords were 0.2c and 0.15c; the aileron was fitted with a balance tab of 0.05c chord. Measurements were made of the hinge moments, lift increments (from which the rolling moments were deduced), and the pressures in the aileron gaps just above and below the seals. The latter were required for estimating the effect of internal shrouded nose (or pressure) balances. Tests were also made of the effect on the hinge and rolling moments of a small spoiler situated just aft of the front aileron vent; the spoiler was assumed to emerge on the lower surface of the down-going aileron and on the upper surface of the up-going aileron.

N-21804 \*

Aeronautical Research Council (Gt. Brit.)  
INFLUENCE OF TUNED DAMPERS ON FLEXURE-AILERON FLUTTER. Part I: THEORETICAL INVESTIGATION ON THE INFLUENCE OF TUNED DAMPING DEVICES ON FLEXURE-AILERON FLUTTER. R. A. Frazer and W. P. Jones. Part II: SOME FURTHER CALCULATIONS ON THE INFLUENCE OF TUNED DAMPING DEVICES ON FLEXURE-AILERON FLUTTER. W. P. Jones. Part III: EXPERIMENTS ON THE EFFECT OF TUNED DAMPING DEVICES ON FLEXURE-AILERON FLUTTER. C. Scruton, D. V. Dunsdon and P. M. Ray. 1952. 31p. diagrs., 5 tabs. (ARC R & M 2559. Formerly ARC 8581; ARC 9946; ARC 9882)

In part I, a general theory has been developed for the investigation of the influence of damping devices of various types on flexure-aileron flutter. The numerical applications refer to a large transport aircraft, and they are restricted to the case of a mass-balanced aileron-carried damper. From the diagrams given at the end of the part, it is inferred that this type of damper would be unsatisfactory as a flutter preventive. Part II supplements part I and gives results for a partly balanced and for a completely balanced aileron-damper system. It is concluded that tuned dampers of these types would also prove unreliable. Part III describes an experimental investigation into the effect on flexure-aileron flutter of a tuned damping device attached to the aileron. The results confirm the theoretical conclusion that the use of an aileron-carried damper would not be a reliable flutter preventive.

N-21805\*

Aeronautical Research Council (Gt. Brit.)  
COMBUSTION IN THE GAS TURBINE - A SURVEY  
OF WAR-TIME RESEARCH AND DEVELOPMENT.  
Peter Lloyd. 1952. 45p. diags., 8 tabs. (ARC  
R & M 2579; ARC 11, 435. Formerly Power Jets  
Research and Development, Ltd. Special Rept. 510)

The present report attempts a general survey of the whole field of gas-turbine combustion. The report covers both research and development, and while it is mainly concerned with British work, some mention is also made of German work on the same subject. The related processes of combustion in propulsive ducts are briefly touched on. The report is based on a paper to the Institution of Mechanical Engineers, but with much fresh material, including a comprehensive bibliography. There have been many groups of investigators concerned in this work at the Royal Aircraft Establishment, Power Jets, Joseph Lucas and Co., the Asiatic Petroleum Co., Metropolitan Vickers Ltd., Rolls-Royce, Armstrong Siddeley's, De Havillands and the City and Guilds College. In preparing the present report, full use has been made of the work of all these groups and of the Combustion Panel of the Ministry of Aircraft Production's Gas Turbine Collaboration Committee through which they cooperated; this debt is gratefully acknowledged. On the other hand, the interpretation and assessment of the work are the author's, and for these full responsibility is taken.

N-21806\*

Aeronautical Research Council (Gt. Brit.)  
THE LAMINAR BOUNDARY LAYER ASSOCIATED  
WITH THE RETARDED FLOW OF A COMPRESSIBLE FLUID. C. R. Illingworth. 1953. 23p.  
diags., 4 tabs. (ARC R & M 2590. Formerly  
ARC 9886; FM 975)

Two aspects of the solution of the equations governing steady gas flow in a laminar boundary layer, when the main stream velocity is nonuniform, are considered. In the first place, it is shown that the equations can be reduced to ordinary differential equations, whose solution implies the similarity of the distributions of velocity and temperature in planes perpendicular to the boundary, only in the case when the main stream velocity is uniform. In the second part, an extension of Pohlhausen's method is used to determine the point of separation of the boundary layer in an air flow in which the pressure increases with a uniform gradient.

N-21807\*

Aeronautical Research Council (Gt. Brit.)  
THE ASYMPTOTIC THEORY OF BOUNDARY-LAYER  
FLOW WITH SUCTION. PART I: THE THEORY  
OF SIMILAR VELOCITY DISTRIBUTIONS. PART II:  
FLOW WITH UNIFORM SUCTION. PART III: FLOW  
WITH VARIATION OF SUCTION VELOCITY. E. J.  
Watson. 1952. 45p. diags., 13 tabs. (ARC  
R & M 2619. Formerly ARC 9906; FM 977; ARC  
10, 025; FM 993; ARC 10, 317; FM 1063; ARC  
10, 852; FM 1148)

The subject of this report is the steady two-dimensional flow of a boundary layer over a permeable surface through which the fluid is withdrawn at a known rate of suction. This rate of suction is assumed, in accordance with the hypotheses of the boundary layer, to be small compared with the stream velocity, and of order  $R^{-1/2}$ , where  $R$  is the Reynolds number. It is supposed here that the suction is relatively large, though still of the same order. Part I deals with the similar solutions of the boundary-layer equations, part II with an arbitrary pressure distribution but constant suction velocity, and part III with the general problem.

N-21808\*

Aeronautical Research Council (Gt. Brit.)  
SANDWICH CONSTRUCTION AND CORE  
MATERIALS. PART IV. Section I: 'BALSOLITE'  
IMPREGNATED PAPER CELLULAR MATERIAL AS  
AN ELASTIC STABILISER. W. J. Pullen.  
Section II: COMPRESSION TESTS ON SANDWICH  
PANELS WITH 'BALSOLITE' CORES. R. G.  
Chapman and S. Pearson. Section III: STRENGTH  
TESTS OF A TYPHOON TYPE FUSELAGE OF  
'BALSOLITE' SANDWICH CONSTRUCTION. J. K.  
Oaks. 1952. 18p. diags., photos., 5 tabs.  
(ARC R & M 2687; 10, 212. Formerly ARC 7267;  
Strut 746; Plas. 45; RAE SME 268; RAE Test  
Note 122)

A range of struts each consisting of "Balsolite" filler sandwiched between two faces of 1/16-inch thick birch plywood has been tested in order to assess the efficiency of Balsolite as a stabilizer in sandwich structures. It is concluded that this material compares favorably with other low density materials when used as a stabilizer. Modification of the material, namely the use of transverse and longitudinal tubes alternately, does not appear to be beneficial.

N-21809\*

Aeronautical Research Council (Gt. Brit.)  
SOME INVESTIGATIONS ON THIN NOSE-SUCTION  
AEROFOILS. J. Williams. Part I: A COMPARISON  
OF THE STALLING PROPERTIES OF SOME  
THIN NOSE-SUCTION AEROFOILS. Part II: A  
THEORETICAL INVESTIGATION ON THIN HIGH-  
LIFT AEROFOILS SPECIALLY DESIGNED FOR  
NOSE-SLOT SUCTION. 1952. 28p. diags., 10  
tabs. (ARC R & M 2693. Formerly ARC 11, 560;  
Perf. 455; FM 1255; ARC 12, 144; Perf. 528;  
FM 1334; ARC 13, 090)

In part I, the experimental results from stalling tests on thin nose-suction airfoils are compared and the design features of the tested airfoils are analyzed. The airfoils include the 8-percent-thick Lighthill and Glauert sections specially designed for nose-slot suction, the 8-percent-thick H.S.A. V section with distributed suction through a porous nose, and some conventional sections of moderate thickness tested in Germany with slot suction at various positions on the nose. Part II describes a theoretical exploration of possible thin nose-slot

airfoils specially designed to have an abrupt fall in velocity where suction is to be applied on the upper surface of the nose.

N-21810 \*

Aeronautical Research Council (Gt. Brit.)  
TANK TESTS ON A JET-PROPELLED BOAT-  
SEAPLANE FIGHTER (SAUNDERS-ROE E6/44).  
G. L. Fletcher. 1952. 31p. photos., diagrs., 6  
tabs. (ARC R & M 2718; ARC 9404. Formerly  
RAE Aero 2106)

Investigations into porpoising stability, water resistance, and seaworthiness have been made on the hull design of the E6/44. The original lines were unsatisfactory for seaworthiness and porpoising stability at overload and modifications to improve these qualities have been made. Results on the final lines indicate that porpoising stability should be adequate at all loads up to the design overload, and take-off time should be well within the specified limit. Seaworthiness tests show that the limiting condition for satisfactory operation at normal load is a 2-foot sea. The hump spray is severe and, due to likelihood of damage, full advantage of flaps may not be gained unless a preselector control is used.

N-21811 \*

Aeronautical Research Council (Gt. Brit.)  
THE SCOPE AND ACCURACY OF VORTEX  
LATTICE THEORY. V. M. Falkner. 1952. 30p.  
diagrs., 16 tabs. (ARC R & M 2740. Formerly  
ARC 12,743; Perf. 607)

This report gives an outline of the development of the principles on which potential problems in lifting-plane theory are solved by the use of a vortex lattice for the purpose of computing downwash. The conditions of convergence necessary for an accurate solution are defined, and the main purpose of the report is to show that those connected with the lattice have been, or can easily be satisfied.

N-21812 \*

Aeronautical Research Council (Gt. Brit.)  
FLUTTER AND DIVERGENCE OF SWEEP-BACK  
AND SWEEP-FORWARD WINGS. A. W. Babister.  
1953. 13p. diagrs. (ARC R & M 2761; ARC  
13,391. Formerly College of Aeronautics,  
Cranfield, Rept. 39)

In this note, the equations of the flexural-torsional flutter of a swept wing are established, assuming the wing to be semirigid and fixed at the root. The general effects of sweepback, wing stiffness, and position of the inertia axis are determined. The critical speeds for flutter and for wing divergence are determined (1) for incompressible flow and (2) for compressible flow, applying the Glauert correction. The critical flutter speed is, in general, higher for a sweptback wing having the same wing stiffness as the unswept wing; for a sweptforward wing, divergence will occur before flutter.

N-21813 \*

Aeronautical Research Council (Gt. Brit.)  
A METHOD OF PERFORMANCE REDUCTION FOR  
HELICOPTERS. F. O'Hara. 1952. 12p. diagrs.  
(ARC R & M 2770; ARC 11,062. Formerly AFEE  
Res. 26)

The equations for helicopter performance are derived in a form suitable for the development of performance reduction methods, and the equations obtained provide also a simple method of performance estimation. Formulas are determined for reducing observed performance data to standard temperature conditions and for estimating the effect of weight changes on performance. Charts of the relationships are given for typical values of helicopter and engine characteristics. The general equations are divided into two groups dealing, respectively, with forward and vertical flight. Performance reduction methods are then outlined for the three cases of climbing, level, and vertical flight and are applied to show the effect of weight changes in each case.

N-21976 \*

Ministry of Supply (Gt. Brit.)  
A GRAPHICAL METHOD FOR THE RAPID ESTIMATION OF HELICOPTER PERFORMANCE. A.  
Armitage. January 1953. 25p. diagrs.  
(Ministry of Supply. RD(H)/F. 20/1)

A method of rapid estimation of helicopter flight performance is presented, with nomographic charts which save much time in calculation, for example, up to 75 percent of that taken by other current methods. The method is based on familiar helicopter theory, and was originally evolved by Capt. R. N. Liptrot when head of the department. It has now been revised and extended to cover such aspects as vertical rate of climb, and tip stall at high forward speed. The working charts have also been prepared and are included. The charts are particularly useful in rapid assessment of the worth of new projects, and in estimating the effect of varying one or more design parameters of both new and existing designs. Only standard parameters and three special factors are employed. The method compares favorably with other accepted methods. A specimen calculation performed on an actual helicopter, together with the comparable flight test values, is included as an appendix.

N-21977 \*

National Gas Turbine Establishment (Gt. Brit.)  
CONVECTIVE HEAT TRANSFER IN A VORTEX  
CHAMBER. D. G. H. Higgins. December 1952.  
24p. diagrs. (NGTE R. 127)

This report describes convective heat-transfer measurements made on a parallel walled "cyclone" vortex chamber, embracing the variables of chamber size, mass flow, inlet temperature, and inlet velocity, and establishes a correlation between Nusselt number and Reynolds number for that portion of the vortex flow unaffected by inlet and outlet

conditions, from which heat-transfer coefficients between gas and wall may be estimated. A curve is given showing the effect of inlet and outlet conditions on this correlation and suggested methods of computing the heat-transfer coefficients in these regions are included. The coefficients so obtained are for the convective component of heat transfer only, radiation effects being neglected in the tests since no combustion of fuel took place within the test chamber itself.

N-21978 \*

Royal Aircraft Establishment (Gt. Brit.)  
A PULSE-OPERATED AUTO-CORRELATOR. F. W. Stoneman. December 1952. 18p. diags. (RAE Tech. Note GW 225)

A pulse-operated auto-correlator offers advantages over other forms of correlator in its comparative simplicity and its ability, under certain conditions of use, to provide a complete correlogram without the necessity of recording the input data. The system involves the storage of information on a series of condensers connected to the contact banks of two uniselectors, the wipers of which can be rotated at the same speed but with any desired angular separation, equivalent to the required values of  $\tau$ , the correlation interval. Theoretically the results obtained are accurate for a repetitive function if the sampling rate is more than twice the highest frequency component. A test instrument has been built which demonstrates that the principle is sound, and provides the basis of a practical machine. The main difficulties requiring further investigation are listed in the conclusions.

N-21979 \*

Aeroplane and Armament Experimental Establishment (Gt. Brit.) GROUND POWER CHECKING OF HELICOPTER ENGINES. TESTS WITH A HOVERFLY 1. D. A. Wilkinson. August 29, 1952. 12p. photos., diags., tab. (AAEE/Res/268)

A preliminary investigation has been made on a Hoverfly 1 of the possibility of ground checking the power of helicopter engines. Tests have been made with both standard blades and blades fitted with attachments. These tests confirm that power checks which involve tethering are unsatisfactory and indicate that power checks should be made under low lift conditions. Two methods of achieving this condition were investigated, one using lift spoilers at high pitch, and the other using drag plates at low pitch. The latter method proved to be the more satisfactory and appears to provide a practical solution, without undue handling problems, by which power variations of the order of 2 percent could be detected. This method may be suitable for use by qualified ground crew provided that precautions are taken to prevent the occurrence of dangerous blade motions.

N-23023 \*

Aeronautical Research Council (Gt. Brit.)  
THE SOURCE DISTRIBUTION REPRESENTING SUPERSONIC FLOW PAST SLENDER BODIES OF REVOLUTION HAVING DISCONTINUITIES IN THE BOUNDARY GRADIENT. L. J. Morton. November 21, 1951. 14p. diags. (ARC 14, 436; FM 1633)

The distribution of source strength along the axis, based on the linearized equation, which represents supersonic flow over a body of revolution is determined for a body having a discontinuity in the boundary gradient. The method consists of a step-by-step process which is applicable when the shape of the boundary is not easily expressible in an analytical form, and formulas are given for the velocity components and change in pressure at the discontinuity.

N-23024 \*

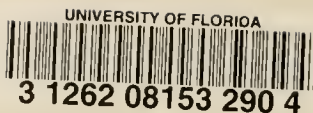
Aeronautical Research Council (Gt. Brit.)  
A SIMPLE AND ACCURATE METHOD FOR COMPARING MANOMETERS. J. H. Preston. June 8, 1951. 7p. diagr. (ARC 14, 072; TP 340)

It is shown that the simple device of a water-sealed reservoir enables a constant pressure difference to be applied to the manometers under comparison. Effects due to temperature changes in the reservoir and the interaction of the adjustment of one manometer on the indication of the other are negligible compared with the observed effects when a completely closed reservoir is used. A theoretical explanation of this is given. The readings of two manometers can be compared with an accuracy which is limited only by the sensitivity of the manometers and the amount of zero creep due to room temperature changes.

N-23025 \*

Aeronautical Research Council (Gt. Brit.)  
EXPERIMENTS ON TWO-DIMENSIONAL SUPERSONIC FLOW IN CORNERS AND OVER CONCAVE SURFACES. N. H. Johannesen. January 29, 1952. 20p. diags., photos. (ARC 14, 607; FM 1669)

Two simple cases of two-dimensional supersonic flow were investigated by schlieren photography, namely the flow in two consecutive corners and the flow over a circular-arc profile concave to the stream. The flows were photographed for smooth and rough surfaces of the models, that is, with laminar and turbulent boundary layers, and the observed flow patterns are compared with those predicted by inviscid theory. The flow with a turbulent boundary layer was in good agreement with inviscid theory outside the boundary layer, whereas the laminar boundary layer separated and a shock wave originated at the point of separation. In both cases, the agreement was good at points far from the surface. A discussion is given of the flow at the point of intersection of three shock waves, and of a shock wave and a centered compression. For the latter case, photographs show a weak shock wave in the direction of the downstream Mach line at the point of intersection.



N-23036 \*

Aeronautical Research Council (Gt. Brit.)  
THE FLOW IN THE THREAT OF A SUPERSONIC  
EFFUSER. W. F. Cope and R. O. Gibson.  
August 23, 1951. 10p. diagrs. (ARC 14, 214;  
FM 1595)

The velocity profiles have been calculated for two radii of curvature and two values of  $\gamma$  for each radius. They are considerably affected by the radius and hardly at all by  $\gamma$ . Comparison with Hermann's results suggests that his "X shocks" may be a supersaturation phenomenon. It is proposed to calculate the flow further down the effuser by including more terms of the series for the velocity potential and using a boundary curve which has a point of inflection.

## MISCELLANEOUS

NACA Rept. 1071

Errata No. 1 on "THEORETICAL SYMMETRIC  
SPAN LOADING DUE TO FLAP DEFLECTION FOR  
WINGS OF ARBITRARY PLAN FORM AT SUBSONIC  
SPEEDS." John DeYoung. 1952.

NACA TN 2890

Errata No. 1 on "A LINEAR TIME-TEMPERATURE  
RELATION FOR EXTRAPOLATION OF CREEP AND  
STRESS-RUPTURE DATA." S. S. Manson and A.  
M. Haferd. March 1953.

NACA TN 2922

Errata No. 1 on "THE DESIGN OF VARIABLE MACH  
NUMBER ASYMMETRIC SUPERSONIC NOZZLES BY  
TWO PROCEDURES EMPLOYING INCLINED AND  
CURVED SONIC LINES." Clarence A. Syvertson  
and Raymond C. Savin. March 1953.

NACA TM 1317

Errata No. 1 on "A SIMPLE NUMERICAL METHOD  
FOR THE CALCULATION OF THE LAMINAR  
BOUNDARY LAYER." K. Schröder. April 1953.

## UNPUBLISHED PAPERS

N-18009 \*

TEMPERATURE VARIATION AND TEMPERATURE  
STRESSES IN PLATE AND SHELL-SHAPED BODIES.  
PART I. (Temperaturverlauf und Tempera-  
turspannungen in platten- und schalenformigen  
Körpern). K. Marguerre. January 1953. 22p.  
diagrs. (Trans. from Ingenieur-Archiv, v. 8,  
June 1937, p. 216-228)

The following bases for a theory of the heat stress on plate (or shell-shaped) bodies are investigated: the (purely thermal) differential equations for the variation of certain mean values of temperature and the (thermoelastic) differential equations for stretching and bending of the plate exposed to a change in temperature.

N-22617 \*

MACHINE TOOL CONTROL FROM A DIGITAL-  
ANALOG COMPUTER. Harry W. Mergler,  
George J. Moshos and Allen E. Young. 1952. 25p.  
diagrs., photos. (Presented at American Institute  
of Electrical Engineers meeting, Albany, New York,  
October 29-31, 1952)

This report describes the development of automatic machine tool controls for the use in fabrication of turbine blades. The following are described: (1) a technique for preparing the coordinate of dimensional data describing the profile to be machined in the form of punched card intelligence, (2) a device to interpolate between these discrete data points to generate a continuous profile represented as a mechanical position, and (3) a servo system duplicating this mechanical position at a high power level to drive the coordinate controls of a machine tool.

N-22876 \*

National Bureau of Standards.  
PROTECTIVE VALUE OF SURFACE TREATMENTS  
FOR MAGNESIUM ALLOYS. Fred M. Reinhart.  
December 1, 1952. 1, 31p. photos., 5 tabs.  
(National Bureau of Standards. Rept. 2026)

This report presents the results of a study of the relative efficiencies of various surface treatments for magnesium alloys with respect to their ability to improve the adherence of paint and thus improve the general corrosion resistance of these alloys when exposed to marine atmosphere and tidewater environments. The protective value of eleven different painted surface treatments on three types of magnesium alloys in salt fog, marine atmosphere and tidewater environments were determined.

## TECHNICAL FILM

NACA Technical Film No. 26 \*

NACA CRASH-FIRE RESEARCH. 1 reel, 1600 ft.  
sound and color.

This film covers full-scale aircraft crashes which were made to investigate the mechanism of the start and development of aircraft crash fires. This investigation revealed the characteristics of the ignition sources, the manner in which the combustibles spread, the mechanism of the union of the combustibles and ignition sources, and the pertinent factors governing the development of crash fire as observed in this program.